

## Anadromous Fish and the Santee Cooper System

*Doug Cooke, Fisheries Biologist, SCDNR*

Anadromous fish spend most of their lives in the saltwater environment of oceans and bays, but return to freshwater rivers and streams to spawn. Some of the best known anadromous fish are salmon, which are often shown jumping over rapids as they migrate upstream to spawning areas.

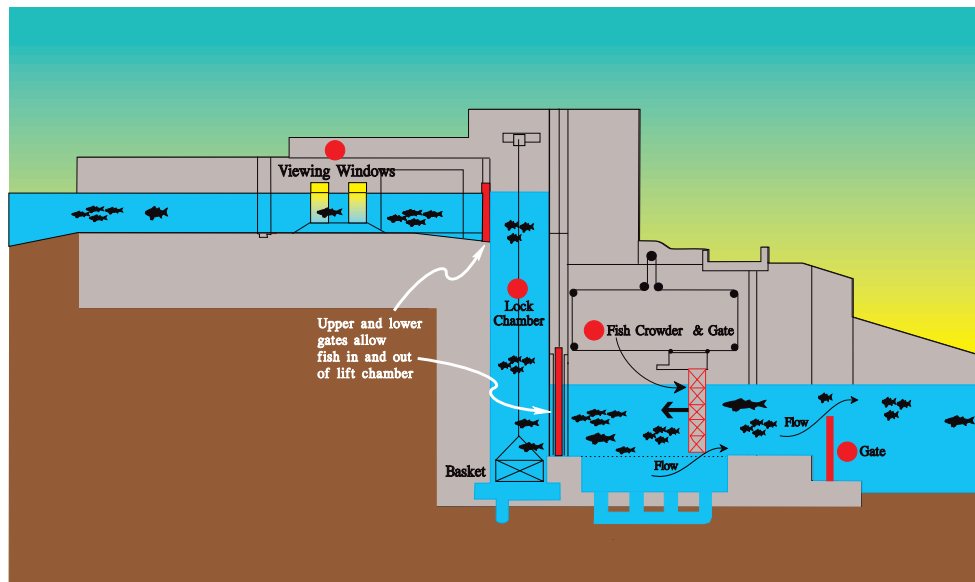
In the Santee Cooper system, there are several species of anadromous fish, including blueback herring, American shad, striped bass, hickory shad, shortnose sturgeon and Atlantic sturgeon. Of these, the blueback herring and American shad are quite abundant, while the shortnose sturgeon is so rare that it is considered an endangered species. Each spring these fish make their migration runs up our rivers in search of suitable spawning areas.

Between spawning runs, some fish like the striped bass and shortnose sturgeon, make migrations within the system, while others make extensive ocean migrations. Biologists have found that blueback herring and American shad spawned in Santee Cooper system may migrate over 1,000 miles to the Bay of Fundy in Canada's Atlantic provinces. Here they are joined by shad and herring from other rivers along the Eastern Seaboard and spend their autumns feeding on the bay's abundant plankton resources.

Shad and herring will continue to make annual migrations up and down the Atlantic seaboard until they reach maturity around the age of four or five. At this time, fish will actually seek out the river in which they were spawned. The mechanism that these fish use

a man-made passageway is needed so fish may pass around the obstruction and reach their spawning grounds.

Although fishways have historically been used at dams to allow passage, many have not functioned well. Biologists and engineers continue to develop passage facilities which allow fish to freely migrate to and from their spawning areas. Currently, a variety of facilities, such as fish ladders, fish lifts, and navigation locks are used to allow fish passage. In the Santee Cooper system a navigation (boat) lock and a fish lift are



*St. Stephen Power Plant Fish Lock Facilities.*

to guide them on these journeys is not fully understood. One theory is that the fish actually memorize the smell of a particular river and use this smell to guide them to their "home river."

As the fish leave saltwater and ascend to freshwater streams, various physiological processes take place. These adaptations are unique to anadromous fish, as changes from saltwater to freshwater would usually be lethal. Fish may travel over 100 miles up freshwater rivers to reach their spawning grounds and have evolved the ability to navigate rapids and many other natural obstructions. However, man-made obstructions, such as dams, are a particular problem;

utilized by migrating fish to pass from the Santee and Cooper rivers into the lakes and rivers beyond.

### THE SANTEE COOPER SYSTEM

The water of the Santee and Cooper rivers has been manipulated by man for over 200 years for several different uses. When this area was first being settled, low marshy areas along the rivers were diked off and flooded to produce rice fields. In 1800, a 22-mile long, 10-lock canal was completed that connected the Santee and Cooper rivers which allowed goods to be

*Continued on page 2*

delivered from the central Carolinas to Charleston on barges drawn by horses or mules. The canal closed in the 1850's and is now overgrown or flooded by the Santee Cooper Lakes. The biggest change to the rivers occurred in 1941 when Santee River was dammed, creating lakes Moultrie and Marion. The water from Santee River, one of the largest drainages on the East Coast, was diverted to the small tidal Cooper River. The project was constructed by the South Carolina Public Service Authority, now known as Santee Cooper.

Besides providing hydroelectric power to an energy-starved rural area and minimizing the periodic flooding of the Santee watershed, the country's first landlocked striped bass fishery was created in the newly formed lakes. Unfortunately, the Santee River Dam also blocked the migration routes of anadromous fish returning to their spawning areas. However, another feature of the original project provided migrating fish access above the Cooper River Dam: the dam was designed with a boat lock that would allow boats to pass between the Cooper River and Lake Moultrie. The lock was intended to allow commercial boat traffic to move between Charleston and Columbia. While commercial boat traffic never became established, the lock, along with corresponding high spring discharges at the dam, provided a reliable fish passage facility.

Each spring, the lock was opened several times a day to allow anadromous fish, which had concentrated at the base of the dam, to pass into the lakes; this provided fish access to spawning and nursery grounds within the lakes and rivers above the dam. Fish living in the lakes also benefited from a fresh supply of food, as they fed on blueback herring which migrated into the lakes. Eggs and young of anadromous fish spawned in the lake system also provide resident fish with an additional source of nourishment.

While the lock worked well in passing fish above the new dam, a problem occurred with the Santee River diversion. Prior to the diversion, the Cooper River, a small, tidal creek, emptied into Charleston Harbor. After the diversion, flow in the Cooper River was increased by water diverted from the Santee rivers. The increased flow created shoaling problems in the harbor that interfered with shipping traffic. Dredging costs dramatically increased and available sediment deposit sites were quickly filled. To correct this problem, while keeping the fish passage and hydroelectric power generation provided by

the original water diversion, the U.S. Army Corps of Engineers proposed the Cooper River Rediversion Project.

Rediversion allowed flow from the Santee River to be diverted into Lake Moultrie; however, a portion of the flow was diverted back to the Santee River via a new canal, known as the Rediversion Canal so that flow to the Cooper River could be decreased. A dam was constructed on the Rediversion Canal to maintain hydroelectric power. A lock, specifically designed for fish was built into the dam to allow passage beyond the new dam and into the lake system.

The new fish lift was much smaller than the original lock on Cooper River. Special gates were designed to create flows which would attract fish into a long entrance channel. Once in this channel, a gate closes behind the fish and forces them into the lock chamber. The lock then floods, just as a boat lock does, and lifts the fish up to lake level. As the fish exit toward the lake system, they pass by viewing windows, where they can be identified and counted; this allows fishery biologists to collect information on the various species of migrating fish entering the lake, which is useful in the proper management of the fisheries. The viewing windows also provide an underwater parade for visitors to watch as hundreds of thousands of fish pass by each spring.

However, after rediversion, the numbers of fish passed into the lakes drastically declined. The U.S. Army Corps of Engineers and Santee Cooper have been working closely with Department of Natural Resources personnel to restore fish passage numbers to pre-rediversion levels. The Corps of Engineers, who constructed and maintains the fish lift, has been funding ongoing fishery studies to provide the best possible access to the lakes for the migrating fish. Numerous modifications to the fish lift have taken place since its original construction and more structural changes are currently being studied. These changes will increase the lift's efficiency in terms of the number of fish passed and the reliability of its operations.

Santee Cooper, who constructed and maintains the boat lock on the Cooper River, has operated that lock for fish passage for the past several decades. They have also provided favorable water discharges to allow fish access to both facilities. It is hoped that through these cooperative efforts, anadromous fish populations will return to previous numbers. As more adult fish are

allowed access to the thousands of acres of spawning and nursery grounds in the lake system, more young fish will be spawned, which in turn will come back in four to five years to spawn even more fish. The resident fish, such as striped bass and largemouth bass, are benefitting from the increased amount of prey available in the lake, while fishermen are benefitting both directly, as they fish for anadromous species, and indirectly, as they harvest fish that forage on anadromous species.



## **Lynches River Festival**

**May 20, 2000**

The 4<sup>th</sup> annual Lynches River Festival will be held at Lee State Park near Bishopville, SC on May 20, 2000. The festival offers hands-on activities, exhibits and workshops covering a variety of outdoor topics for people of all ages. Hours are 9 am to 4 pm. To get to Lee State Park, take I-20 to exit 123 and follow the signs to the park. Admission is free. For more information, contact Lynn Quattro at (803) 734-9094.



## **South Carolina River News**

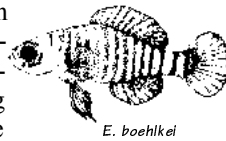
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## Rare Pygmy Sunfishes in South Carolina

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The South Carolina Heritage Trust lists 134 vertebrate species that are of concern to state and local agencies. Twelve 'listed' animals are fishes. Seven fish species are of concern because they are uncommon within the state, but can be found in larger numbers throughout their entire ranges (banded killifish, banded darter, blacknose dace, bluefin killifish, christmas darter, fantail darter, redlip shiner). One species, the shortnose sturgeon, was historically widespread along the Atlantic coast but now extremely rare, and is considered endangered by state and federal agencies. The remaining four species are listed because they are relatively rare and a substantial portion of their range lies within South Carolina (bluebarred pygmy sunfish, Carolina pygmy sunfish, Carolina darter, sandhills chub). This is particularly true of the two pygmy sunfishes whose range encompasses most major South Carolina rivers from the Savannah River north to the Waccamaw River (including small portions of North Carolina).

The bluebarred pygmy sunfish (*Elassoma okatie*) occupies heavily vegetated slow-moving streams and roadside ditches from the Savannah River north to the Edisto River and is relatively common in the southern portions of the state. The Carolina pygmy sunfish (*E. boehlkei*) is comparatively rare, known only from three areas representing two river drainages: (1) the upper reaches of the Waccamaw River where it is perhaps most abundant, (2) an abandoned rice field near Georgetown, and (3) a tributary to the Santee River in Kershaw County.



Pygmy sunfishes are interesting subjects for biological study. As their name implies, the bluebarred and Carolina pygmy sunfish are very small averaging less than two centimeters in length. Both species spawn in the spring when females lay eggs on submergent vegetation, and the parents probably die soon after.

Beyond their unique life history, do these two rare species have any 'intrinsic worth' that necessitates protection from extinction? From a monetary perspective, perhaps not, beyond the fact that males of both species become brilliantly colored during the spawning season and are of some importance (however minor) to the aquarium industry. Beyond aesthetic value, the Carolina pygmy sunfish is uncharacteristically tolerant of acidic water; perhaps the species is of some value to studies of the detrimental effects of acid precipitation.

Admittedly, the importance of these fish to scientific study or the pet trade has little impact on the average citizen of South Carolina. Why then should these species be preserved? The true value of these small fishes lies not in tangible worth but in their contribution to the environmental legacy of the state. If the bluebarred and Carolina pygmy sunfish are lost to extinction, then a relatively large portion of those rare species defining the uniqueness of South Carolina's rivers and streams has been extinguished.

## River Naturalist Dragonflies and Damselflies

James B. Glover, Ph.D., Bureau of Water, SCDHEC



dragonfly

When I was a child a common sight near our farm pond were the many "snake doctors" which would zip around in the air catching mosquitoes and defending their territories. While I loved to watch these beautiful creatures, I was always careful to keep my distance because my mother had told me they would sting. "Snake doctors" are dragonflies and damselflies and, of course, do not sting. Their order name, Odonata (Greek *odon*, a tooth; as in Orthodontist), refers to the strong and sharply toothed jaws that are

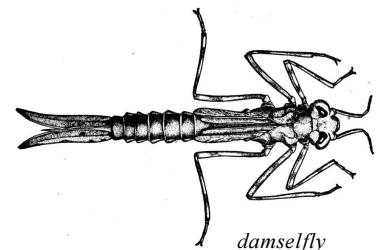
the outward sign of their predatory habits. In life, dragonfly adults are easily distinguished from damselflies in that the former holds its wings outright from its body when at rest while the latter folds its wings above its body. Dragonflies are also more robust than damselflies and apparently are better fliers.

Many adult dragonflies and damselflies are beautifully colored and have attracted the interest of naturalists. They recently have also found their way into our popular culture. Their form can be found on lamp shades, pendants, earrings, and clothing.

While the adult stage is familiar to even the most casual observer, the larva, or nymph, is unknown by most. Most of a dragonfly or damselfly's life is spent under the water in streams, rivers, and lakes. It may take two or three years for the animal to complete its aquatic nymphal stage before changing into the winged adult. The nymphs are as equally voracious carnivores as the adults, using their lower lips, or labiums, to subdue their prey. Their

diet consists of other aquatic insects, tadpoles, and even small fish. The nymphs of damselflies have three external gills attached to the tip of the abdomen, which distinguishes them from dragonfly nymphs that have internal gills.

The worldwide number of described species of Odonata is approximately 5,500, with about 650 species known from North America. There are approximately 132 species of dragonflies and 57 species of damselflies known from the Carolinas.



damselfly



## River Currents

If you have an interest in helping to plan and organize two upcoming **Ashley River clean-up** events set for June and September please contact Ty Houck, manager of Old Dorchester State Park, now at (843) 821-9860.

### Kenneth Strickland Recognized With State Award

If you've spent any time in the Lynches River watershed, it is very likely that you've at least heard the name, Kenneth Strickland. Those of us who have the privilege of knowing and working with him now applaud his latest achievement: recipient of the 1999 SC Environmental Awareness Award, which recognizes outstanding contributions made toward the protection, conservation and improvement of South Carolina's natural resources.

Mr. Strickland grew up in Olanta, SC on the banks of the Lynches River; his love for the river stretches back to his youth when he enjoyed swimming and fishing on his family farm.

Mr. Strickland is a true grass-roots environmentalist. When faced with the knowledge that new permits for discharge to his beloved Lynches River were being sought, he and a group of his friends and neighbors

joined together to form the Lynches River Council, dedicated to protection and improvement of the water quality of the Lynches River. The council was instrumental in having a 54-mile stretch of the Lynches River designated as a State Scenic River in 1994. Mr. Strickland's environmental activism did not end with scenic designation. He continues to serve as vice-chairman of the Lynches Scenic River Advisory Council.

Mr. Strickland is also very humble. His reasons for working to protect the Lynches River are quoted in the management plan:

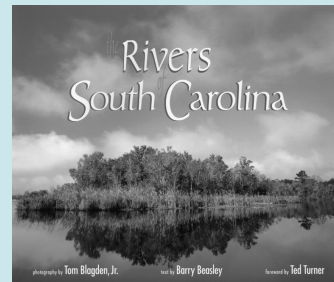
*What we want is to keep the river free from pollution - pure and clean like the good Lord made it. This is from my heart. I grew up on the Lynches River, and I love it. I want my grandchildren and their children to be able to enjoy it as I have.*

Mr. Strickland, those of us that have had opportunity to work with you in protecting the Lynches River salute you!

You can check out all this  
and more via the internet!

<http://water.dnr.state.sc.us>

## the Rivers of South Carolina



Well-known South Carolina Photographer Tom Blagden, Jr., takes you on a pictorial journey down South Carolina's waterways, capturing their beauty on film. Barry Beasley's insightful essays bring the rivers to life and help increase our awareness of the challenges involved in protecting our rivers for future generations of South Carolinians. He introduces the reader to special individuals whose devotion to rivers has created strong, grassroots conservation movements. The South Carolina Department of Natural Resources' River Conservation Program is proud to offer the Rivers of South Carolina. All proceeds go directly to the South Carolina Scenic Rivers Trust Fund. This fund was established in 1989 to help fund river education, conservation and management of South Carolina's Scenic Rivers. To obtain a copy of this book, please mail a check for \$44.25 (includes postage) made payable to SCDNR to our address shown on this newsletter.



### South Carolina River News

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